



INVESTIGATOR'S ANNUAL REPORT

United States Department of the Interior
National Park Service

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OMB # (1024-0236)
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Reporting Year: 2006	Park: Shenandoah NP	Select the type of permit this report addresses: Scientific Study	
Name of principal investigator or responsible official: James Galloway		Office Phone: 434-924-1303	
Mailing address: Dept of Environmental Sciences University of Virginia PO Box 400123 Charlottesville, VA 22904-4123 US		Office FAX 434-982-2137 Office Email jng@virginia.edu	
Additional investigators or key field assistants (first name, last name, office phone, office email) Name: James R. Webb Phone: (434)924-1301 Email: rwebb@virginia.edu			
Project Title (maximum 300 characters): Shenandoah Watershed Study (SWAS)			
Park-assigned Study or Activity #: SHEN-00038	Park-assigned Permit #: SHEN-2004-SCI-0004	Permit Start Date: Jan 01, 2004	Permit Expiration Date: Dec 31, 2009
Scientific Study Starting Date: Jan 01, 1990		Estimated Scientific Study Ending Date: Dec 31, 2057	
For either a Scientific Study or a Science Education Activity, the status is: Continuing		For a Scientific Study that is completed, please check each of the following that applies: <input type="checkbox"/> A final report has been provided to the park or will be provided to the park within the next two years <input type="checkbox"/> Copies of field notes, data files, photos, or other study records, as agreed, have been provided to the park <input type="checkbox"/> All collected and retained specimens have been cataloged into the NPS catalog system and NPS has processed loan agreements as needed	
Activity Type: Research			
Subject/Discipline: Watershed Management / Assessment			

Purpose of Scientific Study or Science Education Activity during the reporting year (maximum 4000 characters):

The Shenandoah Watershed Study (SWAS) has both scientific and practical resource-management objectives. The underlying scientific objective of the SWAS program has been to improve understanding of hydro-biogeochemical processes and factors that govern ecosystem conditions in SNP's mountain watersheds. This scientific objective complements a resource management objective that has been defined by the need to document and assess change that is occurring in SNP's ecosystems.

Findings and status of Scientific Study or accomplishments of Science Education Activity during the reporting year (maximum 4000 characters):

This was the 27th year of watershed monitoring conducted in SHEN by the SWAS program. The monitoring framework currently includes 14 study watersheds selected to represent the major bedrock types in SHEN. Data collection includes quarterly, weekly and

hourly sample collection for analysis of stream water composition, and discharge gauging.

The most significant findings for the 2004 calendar year:

Â· The acidity levels in SWAS study streams during 2004 varied in relation to acidity levels observed prior to 2003. Although 2004 acidity levels were lower in some streams, acidity levels were higher in others, including the four most-acidic study streams.

Â· SWAS study streams were generally less acidic in 2004 than in 2003. This can be attributed to differences in discharge, which was much higher in 2003.

Â· Concentrations of the sum of base cations ($\text{Ca}^{2+} + \text{Mg}^{2+} + \text{Na}^{+} + \text{K}^{+}$) in SWAS study streams in 2004 were generally lower compared with concentrations prior to 2003. This is consistent with long-term depletion of base cations in forest soils due to acidic deposition.

Â· Concentrations of the sum of base cations in SWAS study streams in 2004 varied in comparison with concentrations in 2003. Concentrations in most of the study streams were higher in 2004 than in 2003. This can be attributed to the dilution effect of higher discharge levels in 2003.

Â· Sulfate concentrations in SWAS study streams generally declined in 2004 when compared with concentrations prior to 2003 and in 2003. This is consistent with decreasing deposition of sulfate in precipitation.

Â· Nitrate concentrations in SWAS study streams in 2004 were generally lower compared to concentrations prior to 2003. The higher nitrate levels in earlier years can be attributed to severe forest defoliation in the early 1990s by gypsy moth larva.

Â· Nitrate concentrations in SWAS study streams in 2004 were generally higher compared to concentrations in 2003. This may be reflect the dilution effect of higher discharge levels in 2003. It is also possible that this may reflect recent low levels of forest defoliation by gypsy moth larva.

Â· A significant episodic acidification event occurred in many SWAS study streams in conjunction with high-runoff conditions in September of 2004. The increase in acidity during this event conforms with past observations relating the occurrence of extremes in acidity to high runoff.

For Scientific Studies (not Science Education Activities), were any specimens collected and removed from the park but not destroyed during analysis?	
No	
Funding specifically used in this park this reporting year that was provided by NPS (enter dollar amount): \$52000	Funding specifically used in this park this reporting year that was provided by all other sources (enter dollar amount): \$0
List any other U.S. Government Agencies supporting this study or activity and the funding each provided this reporting year:	

Paperwork Reduction Act Statement: A federal agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. Public reporting for this collection of information is estimated to average 1.625 hours per response, including the time for reviewing instructions, gathering and maintaining data, and completing and reviewing the forms. Direct comments regarding this burden estimate or any aspect of this form to Dr. John G. Dennis, Natural Resources (3127 MIB), National Park Service, 1849 C Street, N.W., Washington, DC 20240.